Remarks

This Reply is responsive to the Office Action dated September 30, 2005 and is accompanied by a two-month petition for extension of time along with an authorization to charge the required statutory fee.

As requested by the Examiner, the title of the invention has been changed to be more clearly indicative of the invention to which the claims are directed, and is copied below (as amended):

METHOD OF DYNAMICALLY CHARGING A BATTERY USING LOAD PROFILE PARAMETERS.

Several typographical errors in the specification have been identified and have been corrected by amendment. Claims 1, 11 and 19 have been amended. No new matter has been added.

Turning now to claim rejections based on cited art, Claims 1-5, 11-14, 17,19-21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Oglesbee et al. (US 6,091,229). Claims 6-10, 15, 16, 18, 22 and 23 are objected to as being dependent upon a rejected base claim, but would allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Before reviewing Oglesbee, Applicant will review the claimed invention as now recited in amended claim 1. Amended claim 1 recites:

1. A method for operating an energy system, comprising the steps of:

providing an application coupled to the energy system, said application comprising a dynamoelectric machine;

measuring electrical characteristics of power drawn comprising voltage and current drawn by the application from the energy system as a function of time to create a running series of time-based measurements;

processing the measured electrical characteristics to produce an energy spectra and a power spectra of a load profile presented by the application to the energy system; and

dynamically charging the energy system based on the energy spectra and the power spectra to a state of charge which is less than a maximum state of charge to provide headroom to permit said energy system to receive regenerative energy from said dynamoelectric machine.

Support for the application being a dynamoelectric machine can be found throughout Applicants' specification, including dynamoelectric machine 14 shown in Fig. 1 and described in the specification. The "voltage and current" is disclosed in several Application locations, including the paragraph beginning on page 4, line 18, as well as in Fig. 2. Support for charging to a "state of charge which is less than a maximum state of charge" can be found in the paragraph beginning on page 9, line 20.

Thus, the claimed method is a charging method that does optimize charging time or efficiency, rather, it deliberately undercharges the battery. Since it is implicit that the battery's performance is based on how much headroom is reserved to accommodate whatever bi-direction flow may occur, the claimed dynamic charging method provides a dynamically alterable target impedance level.

A dynamoelectric such as a hybrid vehicle needs the ability to either charge or discharge all the time. Therefore it is necessary to leave some room to accept charging, but it also wants to keep the battery not-quite-discharged, so it always leaves a little extra energy for discharging. If the vehicle does big accelerations, then the battery will need to keep a lot of extra energy stored up. If the vehicle does big decelerations, then it will need to keep a lot of extra "space" to absorb the regeneration charge. Therefore, the best place to operate the battery would appear to be near the middle of the curve, where it can always have enough energy for the discharges, but also have enough room to absorb charging. However, the Inventor has discovered that the middle is usually not optimized sufficiently. The battery's impedance curves (attached drawing labeled "Clarifying Figure") aren't exactly linear, so the "real" target location may be offset from middle. If a

vehicle's operation favors abrupt accelerations more than sudden braking, the battery should favor discharge power Example: a hybrid city bus may have disproportionate acceleration profiles vs. braking profiles. The battery should favor the disproportionate for highest efficiency.

The claimed invention addresses these issues by tracking the ratio of acceleration and braking through the claimed measurement of current and voltage, and it determines if the battery's impedance should disproportionately favor discharge or charge (instead of operating in the "middle") by updating the SOC through adjustments to the headroom. setting. It does this by taking the claimed "spectra", which is a mathematical word for understanding the input/output of energy and power, which is computed by taking time-series data of voltage and current from the battery.

For example, if the vehicle's energy and power spectra is computed and shows a disproportionate favoritism for acceleration (discharge), the battery is operated in a region that gives better discharge impedance. Therefore, the computed state-of-charge of the battery (based on the claimed headroom) is adjusted. Referring to the Clarifying Figure provided herewith, Therefore, the computed state-of-charge of the battery is moved from the "middle" to the new area labeled "example". The spectra is thus continuously (dynamically) calculated, so that the degree of charging reached during charging is less than fully charged (includes headroom), with the amount of headroom dynamically self-adjusted to a given vehicle, driver behavior, and/or operating environment.

Regarding Oglesbee, the Examiner indicates that:

> Claims 1-5, 11-14, 17, 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oglesbee et al. (US 6,091,229). The reference discloses a method and its apparatus for communicating the power demand of the charger and the power supply unit. The power supply unit processes the power required from the charger and

sends the appropriate energy spectra to the charger. This device employs the charger as a load application. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have replaced the power supply with the charger and the charger with a regular load, since it has been held that rearranging parts of an invention involves only routine skill in the art. *In re Japikse*, 86 USPQ 70.

Oglesbee discloses a battery charger system (10) consisting of a power supply unit (20) and a battery charger unit (70). The power supply unit (20) features a current profile generator (26) that defines a current profile of the output current of the power supply unit (20). The battery charger system (10) provides a unique way of communicating charging current demand between the battery charger unit (70) and the power supply unit (20). The power supply unit (20) is capable of determining the charging current demand by detecting specific logical operating states of the battery charger unit (70), and comparing the current to a set threshold. The battery charger unit (70) communicates charging current demand to the power supply unit (20), and the power supply unit (20) responds by adjusting its output current to meet the required demand.

Col. 3, lines 16-24 of Oglesbee are copied below:

The present invention involves a unique way of communicating charging current demand between the battery charger unit 70 and the power supply unit 20. The power supply unit 20 is capable of determining the charging current demand by detecting specific logical operating states of the battery charger unit 70. The battery charger unit 70 communicates charging current demand to the power supply unit 20, and the power supply unit 20 responds by adjusting its output current to meet the required demand.

Oglesbee thus discloses a battery charger that uses a method (intelligence) to compute how to charge the battery the most in the shortest time with the highest efficiency. Thus, although Oglesbee does disclose an advanced adaptive (non-fixed) charging regimen based on demand of the application, the charging regime always fully

charges the battery. Moreover, Oglesbee does not disclose or suggest applying the disclosed method to a dynamoelectric machine.

In contrast, the claimed method recited in amended claim 1 includes the step of providing an application comprising a dynamoelectric machine, processing measured electrical characteristics to produce an energy spectra and a power spectra of a load profile presented by the application to the energy system, and dynamically charging the energy system based on the energy spectra and the power spectra to a state of charge which is less than a maximum state of charge to provide headroom to permit said energy system to receive regenerative energy from said dynamoelectric machine. Accordingly, amended claim 1 and its respective dependent claims are patentable over the cited art. For analogous reasons, the method recited in amended claim 11 and the system recited in amended claim 19, as well as their respective amended claims are patentable over the cited art.

Applicants believe that the application is now in condition for allowance. However, Applicants invite the Examiner to call the undersigned if it is believed that a telephonic interview (direct line (561) 671-3662) would expedite the prosecution of the application to an allowance.

Respectfully submitted,

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